

AMENDMENTS TO THE DRAWINGS

The attached replacement sheets of drawings include changes to FIGS. 1 and 2. In particular, the label "Prior Art" has been added to FIGS. 1 and 2.

Attachment: 2 replacement sheets

REMARKS

Claims 1-8 are pending in this application. Claims 9-24 have been withdrawn. Claims 1, 4-7, 11, 17 and 19 have been amended, and claims 25 and 26 are new. No new matter is presented.

Applicants acknowledge, with appreciation, the indication of allowability of claim 7.

FIGS. 1 and 2 are objected to because only that which is old is illustrated. FIGS. 1 and 2 have been amended in response to this objection as explained in the Amendments to the Drawings section.

The drawings are objected to under 37 CFR 1.83(a) for failing to show “wherein each row and column contains one area of each electro-optic characteristic” as recited in claim 7.¹ This objection is respectfully traversed.

Claim 7 depends upon claim 2 which introduces the feature that the repeat unit comprises a two dimensional grid. Accordingly, the rows and columns of the grid referred to in claim 7 refer to the rows and columns of the repeat unit. FIG. 10 shows an example of a layer made up of a three-by-three repeat unit. The area indicated A indicates the repeat unit. It can clearly be seen that each row, and each column, of area A comprises one region of characteristic 1, one region of characteristic 2 and one region of characteristic 3. Because the subject matter of claim 7 is clearly shown, withdrawal of the drawing objection is respectfully requested.

Claim 1 is objected to because of a grammatical error. The claim has been amended to overcome this objection.

Claims 1 and 5-7 and the specification are objected to because of insufficient antecedent basis for the limitations “regions”, “switching areas”, “areas”, and “number of regions of areas”. The claims have been amended to overcome these objections. As amended, the term “switching region” is used to refer to a region of the patterned layer which imparts a particular electro-optic characteristic. The term “area of electro-optic characteristic” is used to denote areas found within a

¹ The Action incorrectly identifies claim 5 as reciting this limitation.

pixel of each characteristic – which, for example, may correspond to a whole switching region if that region falls entirely within the pixel, or to only part of a switching region if it only partly falls within the pixel.

Claims 1-8 are rejected under 35 USC 112 as indefinite because certain wherein clauses in claims 1 and 4 are deemed unclear and not understandable. The claims have been amended to overcome this rejection. Claim 1 has been amended to make clear that the pixellated device comprises electrodes which define the pixels (as described, for example, at page 1, lines 14 -15), and that each pixel contains areas of each electro-optic characteristic in the same relative proportion as each other pixel. Claim 1 has been further amended to recite that the repeat unit length of the repeating pattern is less than half the length of the minimum pixel dimension. Support for this amendment may be found, for example, at page 21, lines 24 – 25.

Claims 1-6 are rejected under 35 USC 102(b) on Kwon (US 5,853,818). Claim 8 is rejected under 35 USC 102(b) on Suzuki (US 6,639,642). These rejections are respectfully traversed with respect to claims 1-8, as amended.

The present invention is directed to a repeated pattern layer for a pixellated light modulating device comprising a number of elements in combination. In claim 1, as amended, the combination includes a cell and several switching regions. The cell comprises a light modulating medium and electrodes that define pixels. Each switching region imparts one of at least two electro-optic characteristics to the light modulating medium of the cell. The switching regions are in a repeat unit that has a length less than half the length of the minimum pixel dimension.

A similar combination of features, wherein the repeat unit length is less than half the length of the minimum pixel dimension, is neither disclosed nor suggested in Kwon or Suzuki.

As a matter of background, a pixellated light modulating device, such as a bistable liquid crystal display, has a plurality of pixels defined by the arrangement of electrodes as is well known in the art. It is also known that greyscale can be achieved in such devices by arranging each pixel to

have a number of different regions, each region switching at a different voltage threshold. This allows control of the addressing voltage to control how many regions of the pixel are switched – all, none or some of the regions could be switched to vary the overall transmission of the pixel and achieve greyscale.

Usually this effect is achieved by carefully designing the sizes of the different switching regions to match the size of the electrodes and then, when making the cell, making sure the electrodes are carefully aligned with the switching regions of the cell. This approach requires a different pattern of switching areas to be fabricated for different electrode arrangements. Further, the alignment step adds cost and complexity to the manufacturing process and, if not performed correctly, can lead to noticeable errors in the display.

In contrast, the present invention provides a liquid crystal device which can be fabricated without requiring a mask alignment step and can use the same switching region arrangement with any electrode arrangement above a certain minimum pixel size. The present invention therefore has a patterned repeat layer which has a plurality of switching regions which impart a particular electro-optic characteristic to the light modulating medium. In the example of bistable liquid crystal displays, the characteristic may be the voltage threshold for switching between states. The patterned layer is arranged so that the repeat unit length, i.e. the length of the repeat unit, is less than half the minimum dimension of the pixel.

For example, using hypothetical dimensions to illustrate the point, if the pixel is formed by the overlap of a 40 micron wide row electrode and 30 micron wide column electrode, the pixel is a rectangle of 30 by 40 microns and the minimum dimension is the short side of 30 microns. The repeat unit of the patterned layer of the present invention is therefore less than half of this, i.e. less than 15 microns. The repeat length being significantly smaller than the minimum pixel dimension reduces any error of misalignment as described at page 20, line 6 - page 21, line 27, and also page 24, lines 10 – 19, for example.

The pattern is arranged such that each pixel of the device contains areas of each electro-optic characteristic in the same relative proportion as every other pixel. In other words, if one pixel has equal areas of characteristics 1, 2 and 3, then every other pixel will have equal amounts of characteristic 1, 2 and 3. It should be noted that the size of the pixels is not necessarily the same and therefore a bigger pixel will have a greater area of characteristic 1 than a smaller pixel – however, it is the ratio of the area of characteristic 1 to the area of characteristic 2 in each pixel that remains the same.

Accordingly, the present invention removes the need for a mask alignment step, and hence the edge of a pixel does not necessarily coincide with the end of a switching region. Indeed it is most likely that the edges of several pixels do not coincide with the edge of a switching area or repeat unit. New claim 26 is added to cover this aspect – support can be found, for example, at page 21, lines 1 – 7 and FIG. 10.

Kwon provides no teaching about the relationship between a patterned alignment layer and pixels of a liquid crystal cell. Kwon discusses “pixels” of the photomask used to produce the alignment layer but provides no teaching about whether the resulting light modulating device is pixellated, and certainly provides no teaching that the repeat unit length should be less than half the length of the minimum pixel dimension. Suzuki similarly fails to provide such teachings. Consequently, there is no teaching or suggestion in Kwon or Suzuki of a combination corresponding to the combination defined by amended claims 1-8.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue. If it is determined that a telephone conference would expedite the prosecution of this application, the Examiner is invited to telephone the undersigned at the number given below.

In the event the U.S. Patent and Trademark Office determines that an extension and/or other relief is required, Applicants petition for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to Deposit Account No. 03-1952 referencing docket no. 527122000400.

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Respectfully submitted,

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Attachments

APPENDIX